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ABSTRACT

The interconnection between satellite and cable television systems would have the greatest potential effect on education. Because cable offers per pupil cost saving by the centralization of resources, the advantage of simultaneous programing, and the potential of two way systems (particularly useful in computer-assisted instruction), its link with satellite systems would broaden the national and regional input to the interconnection system. Though the regulatory problems of such a system have been largely solved, and technically the system is feasible, cost prohibitions (particularly the high cost of terrestrial facilities) prevent a concentrated effort to effect the system. The author concludes that public policy should be particularly sensitive. (MC)

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PUBLIC INTEREST ASPECTS OF

CABLE TELEVISION INTERCONNECTION BY SATELLITE

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by
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Public Interest Aspects of Cable Television Interconnection by Satellite

In looking at the public service aspects of interconnecting cable television systems by satellite, there are several things to consider:

> What is the present status and immediate outlook for both cable and satellites?
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> What would be the benefits of interconnection of cable by satellites in providing additional services of value to the public?
>
> What are the technological obstacles to such interconnection?
>
> What are the economic incentives?
>
> Is the present public policy and regulatory action such as to encourage the technological development and economic investment for interconnection?

These are important questions to ask at this time when neither the cable systems nor the domestic satellite systems are hardened, although both appear to be at the threshold of large scale development. And these questions should be answered by long range planning rather than being allowed to be resolved by the contest among vested interest groups with little concern for the public interest.

The Present Status of Cable

There are presently about 2800 cable systems serving approximately 6,000,000 homes. The average system has 11 channels,

and virtually none of the systems is two-way except for some experimental systems.[1]

New cable television rules were adopted by the FCC, effective March 31, 1972. The stated requirements for newly authorized cable systems include (a) a minimum of 20 channels, (b) a limited two-way capability, (c) certain carriage requirements, some of which were one channel for public access, one channel for education, and one channel for local government. There would be no charge for the use of any of these three channels during a "developmental period". The order allowed the importation of distant television station signals in the top 100 markets.

The narrow band return capability of the two-way requirement will allow for most of the interactive services contemplated.

The single channel for education is woefully inadequate. The FCC argued that if full utilization of the single channel could be demonstrated, the requirements could be changed when reviewed in later years.

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[1] Locations of the experimental two-way systems are: Overland Park, Kansas; Akron, Ohio; Orlando, Florida; Jefferson City, Missouri; and Irvine, Texas.

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The intent was that the carriage of all local stations and the importation of distant signals would create enough subscriber demand that cable systems would have the economic incentive to grow. Other services probably could not be sustained until the penetration is at least 50 per cent of all homes.

The Present Status of Satellites

Under the FCC policy of Open Entry, there are presently eight applicants for domestic satellite systems. Four of them have recently expressed their wish to be processed immediately by the FCC./2 The other four have asked for a deferral pending resolution of issues raised in petitions for reconsideration./3 So, although processing of the applications has begun no domestic satellite systems have yet been authorized. The prospect is that some will be soon.

None of the systems proposed includes service for television network distribution, although six of the eight applicants

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/2 Those four are Western Union, Hughes/GT&E, American Satellite Corp. (a newly formed corporation owned by Fairchild Industries, Inc. and Western Union International, Inc.) and RCA.

/3 These four are: AT&T, Comsat, MCI/Lockheed and Western Tele-Communications, Inc.

have said they would scale their system to accommodate the television networks if they had a signed contract with the networks.

It is characteristic of all of these systems that they require an expensive receive terminal (upwards of $100,000). They are all operating in a frequency band of 4 GHz downlink which is congested with terrestrial microwave. Thus, the receive terminals must be located an average of 20 miles from the user in order to avoid frequency interference. The signal must then be relayed from the receive terminal to the user at considerable expense.

One of the applicants, MCI/Lockheed, proposes to operate at a downlink frequency of 12 GHz as well as 4 GHz. Their objective is to locate receive terminals close to or, in fact, on the premises of users since there is no existing terrestrial microwave at 12 GHz.

None of the applicants propose to deploy large numbers of earth stations in the initial systems. The business they are currently seeking is long haul. Hughes has plans to eventually build in the order of 100 receive terminals for the purpose of interconnecting cable systems.

In summary of the present status, the existing cable systems have limited capacity and are one-way. Higher capacity, 2-way systems have been ordered by the FCC for all future authorizations, though the rate at which such systems will be implemented is uncertain. No satellite systems have been authorized, although processing has begun on four of them. The nature of the satellite systems, requiring expensive receive terminals and expensive links to the user may be on economic barrier to cable interconnection. One fortunate circumstance is that domestic satellite systems won't be operational for three years, and by that time cable penetration may have increased to the extent that interconnection by satellite will be closer to economic viability.

Potential Benefits of Interconnection

The following examples of potential services that would benefit the public by no means constitute a complete list. They are chosen to define the characteristics of the system.

Certainly the most important need for expanded telecommunication service is in education. Cable systems offer the potential of per pupil cost savings by centralizing the sources of instructional material and distributing that material in a way that avoids the rigid scheduling of present ITV systems provided enough channels are available. That is one necessary change over present cable

systems. The system must be flexible enough to deliver many different programs to classrooms simultaneously.

One example of program material for classrooms other than the traditional curriculum would be gavel-to-gavel coverage of state or national legislative hearings as raw material for instruction. To provide this type of program the concept of networking is introduced, that is, interconnecting the individual cable system to other sources.

The interactive mode made possible through two-way systems would allow the student to become an active participant rather than a passive observer. Through computer-assisted instruction (CAI), the cable system can offer some degree of individually prescribed instruction. The MITRE Corporation in its Urban Cable Systems Report, November 1971, concluded that the return path in two-way systems should be narrow band for general distribution but be broad band for special point-to-point services. The narrow band return would serve the purpose of CAI, such as the TICCIT system. The central computer terminal of such a system would in many cases be shared by more than one cable system, again a need for a switched network interconnection.

The Open University concept in England has achieved outstanding success in its first full year of operation. It employs over-

the-air program material supplemented by study guides, local instructional centers and one week of summer resident study at a university. The over-the-air material could be distributed by cable which would leave the local public television channel available, and in fact, the British system would be improved if several cable channels could be used.

An Open University concept might very well entail a regional organization, rather than a single community, again a reason for interconnection to a switched network.

As an indication of the interest in the Open University concept, four U.S. universities are making a one-year trial using films in place of the over-the-air video.[4]

Another example of the need for switching is the developing Information Networks such as MEDLARS (Medical Research and Retrieval System) and ERIC (Educational Research Information Center).

The switching centers for cable systems might be under the control of the cable operator, or as an alternative and especially if many of the switched circuits were public service related,

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[4] They are Rutgers, Maryland, California State at San Diego and the fourth one is right here in Houston.

the switching centers could be operated by the public television station in the community.

In general, public television welcomes cable. Unlike our commercial counterparts who view cable as a competitor, public television views cable as a complementary service:

> Cable extends public television coverage, which is especially important in many markets because 60 percent of public television stations are UHF.
>
> Cable can provide multiple channels for additional public television (PTV) and instructional television programs (ITV).
>
> And cable may provide a source of revenue to public broadcasting stations by the station making its production facilities available for local cable programming or, by offering such services as origination and switching of ITV materials.

Other applications of switching into cable channels are:

- Neighborhood production studios could be associated with the PTV station for technical assistance and interconnected through the switching system to local cable channels or to other cable systems outside the franchise area for programs of more-than-local interest. In this way, community level programming would be encouraged.

- The public television station could be the library for video cassettes. The distribution, rather than by shipping cassettes, would be over cable channels according to orders taken on the two-way system. Transmission of the cassettes could be either in real time, as used, or could be sent during low traffic periods late at night, with cassette recorders at the schools actuated from the station. (By suggesting that the PTV station house the library, it becomes a media center. Combined with interconnection to other stations and cable systems, it becomes a telecommunications center, in the sense suggested by William Harley, President of NAEB).

- With multiple channels (national as well as local) a new type of program schedule becomes possible. Perhaps four channels can be earmarked for category programs. The four categories might be (1) news and public affairs, (2) drama, (3) general entertainment, (4) music. Each program in the category would be repeated for convenient availability to the viewer, not bound by the network schedule, and this would increase the chances of excellent programs being seen by the selective viewer.

- If cable systems could be interconnected, special interest groups could be aggregated such as Spanish speaking or professional groups.

So, the switching for the cable system would consist of inputs from a national interconnection, probably by satellite, and inputs from the region and the local community. The outputs of the switching would be to the cable channels and to the national interconnection system. In the case of satellites, this would entail an uplink transmitter terminal.

What are some of the policy issues raised by these suggested functions?

How many channels in each cable system should eventually be reserved for PTV-ITV use?

Who should have access to the channels?

Should the cable operator have authority to control access to channels?

What is the defamation liability of a cable operator who makes channels available to public access?

Should funds be made available for production costs of community service programming?

Should cable operators be required to provide a cable drop at educational institutions without charge?

Will pay TV over cable be allowed?

Would pay TV be allowed for instruction or information, if not for general programming? (This would take care of anti-syphoning rules.)

What, if any, would be the effect of local switching (whether by the cable operator or the PTV station) on common carriers or established networks?

Technological Factors to Interconnection

Having looked at some of the benefits of interconnecting cable systems, and some of the policy questions, the next consideration is whether or not the technology exists and what needs to be developed.

The present state-of-the-art technology would accommodate the services. There are areas in which further development would reduce costs, such as in the home receiver. The services being discussed require that the home receiver be adapted for frame grabbing, a response and inquiry terminal, address sensing, frequency conversion and video cassette record and playback. Certainly those features combined would be out of reach economically today for most viewers.

At the present time, technology exists to compress two color video channels into the bandwidth normally required for transmission of one color video signal. However, the increase in

terminal costs at the receiver would more than outweigh the saving in transmission capital. However, since the number of channels will be at a premium, even in 40-channel cable systems, bandwidth utilization should be studied as applied to instructional service by cable.

> As an example, the Mitre TICCIT system uses each field of video as a separate screen of information, which is totally satisfactory for still frame pictures. If each field is refreshed or changed no oftener than once in 5 seconds, the number of students that can independently address and use one video channel for separate still frame information is 5 times 60 or 300.
>
> If video is converted to digital form, bandwidth compression techniques can be applied. If the program material is monochrome and of a nature that some loss in resolution can be tolerated, as much instructional material is, the possibility exists that as many as 20 channels of information can be transmitted simultaneously on one video channel.

With utilization ratios of 300:1 for still frame and 20:1 for pictures with motion, a cost study should be made to determine the crossover point between savings in transmission costs from increased channel utilization and the additional receiver costs to decode the signal.

Another area requiring work is technical standards. If cable systems are to be interfaced through common switchers, the video and data signals must be compatible. The cassette video tape industry today consists of many formats, most of them incompatible. In-service test signals and performance parameters

must be standardized for cable not only nationally but internationally. PBS last week on behalf of the Network Transmission Committee, conducted tests on its national interconnection of the Japanese and American standards for vertical interval test signals. Each country had proposed different and to some extent conflicting standards at the CMTT meetings in Geneva in July, 1972. This is one example of how broadcasters and, to an increasing extent, cable operators, will have to be involved in standards work.

A significant step in this direction has been taken by the FCC in establishing C-TAC, the Cable Technical Advisory Committee. Most of the nine panels of the Committee will be primarily concerned with the formulation of technical standards.

Two shortcomings of the total system of interconnecting cable by satellites is the high cost of terrestrial environment for presently proposed domestic satellite systems and the relatively low channel capacity of the satellites. In this case, the regulatory problems are largely solved. The World Administrative Radio Conference authorized satellite distribution at 2.5, 7 and 12 GHz, all of which would encounter less frequency congestion on the ground - and consequently fewer or, in many cases, no microwave links from receive terminal to user.

Also, the power flux density limitations would permit the use of relatively low cost receivers if satellite system operators were planning for the large number of receive terminals that would be needed to serve 3000 to 4000 cable systems. In present proposals, the flux density is well below (by about 15 db) the allowable limits.

The shortcoming of too few satellite channels could be overcome to a large extent by the re-use of frequencies, either by multiple receive antennas, one for each of several satellites (which would be costly) or by restricting each downlink beamwidth so that it covered one sixth or one eighth of the continental U.S., rather than each beam covering the entire country. The same frequency band could then be re-used in each beam (several satellite configurations are possible which will achieve the necessary isolation between beams). The number of channels that could be received at any one ground terminal in this subnational distribution pattern is the same as if the beamwidths were national. However, each region within the coverage of one beam can use the channels for programs entirely different from any other region. Thus, the total number of different programs that can be transmitted and received simultaneously in the continental U.S. is n times the

number in any one beam, where n is the number of beams. This sub-national configuration results in increased spectrum utilization only if there is a need for regional programming (time zones are one type of region in this sense). One question that should be studied is what portion of program distribution will be local, regional or national in interconnection of cable systems.

The technology for these features of a domestic satellite system exist. The problem is in making known the requirements of interconnection, especially interconnection of cable systems, to the satellite owner-operators and to the FCC. Most of these technical features will be demonstrated in the educational television experiment on NASA's ATS-F satellite in 1974 (narrow beamwidth, high flux density, downlink frequency at 2.5 GHz and low cost receive terminal).

What Are the Economic Incentives

None of the extended services discussed herein would sustain satellite interconnection of cable systems by itself. Taken together, they might, although that is a study that needs very careful attention. The public policy issues cannot be argued in vague generalities against opponents who know all too well why extended services are against their vested interests.

It's part of the unfinished business to assemble the economic data for a viable economic model.

Does the Present Public Policy Encourage Interconnection?

There are some important policy questions regarding cable and satellite in addition to those mentioned above:

- What is the source of revenue for the public television station, or the programming for the educational cable channels?
- Should cable franchises be given in purpetuity or even for 20 years without safeguards?
- Should the jurisdiction for franchises be under the city or the state (New York, Nevada and Hawaii are moving toward state jurisdiction).
- Should prohibition against cross ownership of cable and broadcast stations apply to PTV stations?

In both cable and satellites, the FCC should examine the technical questions of high channel capacity as it relates to the potential for public service. High channel capacity, coupled with interconnection of cable systems by satellite, will make it possible to economically reach special interest audiences and to provide these audiences with a variety of instructional and public programs from a variety of sources.